Baseline Operational Capability II

For CAT II RFCs

Version 20090428 (final for now)

Background

The CHPS Acceleration Team (CAT) RFCs agreed to establish a "Baseline Operational Capability" as a means of defining and controlling the migration process from NWSRFS to CHPS. The process of defining and negotiating BOC compelled the CAT RFCs to look carefully at the full end-to-end forecasting system and clearly define what would be required to duplicate operations without NWSRFS. This process supported the planning process and served to define and guide software development and model transition activities at OHD and Deltares.

This same process will be used to define the "Baseline Operational Capability" for the nine CAT II RFS, hereafter called BOC II. The BOC document is posted on the CHPS wiki. A review of the latest version (20090502) will show that substantial clarification took place after the document was agreed-to. Those clarifications have been integrated into the initial version of this document.

Definition

BOC II is the minimum set of software, hardware, and information infrastructure to operationally support the nine CAT II RFCs (APRFC, CBRFC, LMRFC, MARFC, MBRFC, NCRFC, OHRFC, SERFC, and WGRFC) in a fashion consistent with their operational service delivery as of January 1, 2009. BOC II necessarily includes all features of the BOC for the CAT RFCs.

This document will be vetted and negotiated with the nine CAT II RFCs and will then serve as a guiding decisional document. Once BOC II is established and implemented, local innovation can be used to evolve the forecasting environment into a form that makes fuller use of the flexibilities and capabilities available within CHPS.

Specifics

The following statements specifically define BOC II.

1. Existing data flows and resources will be directed and re-mapped to provide the same point, areal, and gridded data currently provided to NWSRFS.

    A. Supported data types include those specified in the NWSRFS Users Manual, Chapter 1.4. Additional data types deemed critical for transition may be added to the above list as noted here.

        i. Currently none.

B. The OFSDE utility has been modified to provide data to both NWSRFS and FEWS. The data targeted for FEWS includes an additional “source” identification needed for migration validation and beyond.

   i. This meets an explicit requirement to identify and differentiate data and time series (and grids) developed using different systems and techniques.

C. Migration requires the development of data import/export utilities so that NWSRFS developed time series can be evaluated within FEWS and visa-versa. This includes all point, areal, and gridded data, although no modifications or enhancements will be made to NWSRFS to support this.

D. A means to identify sensitive/proprietary data that must be excluded from external reports is required. (FEWS capability verified 3/24/09).

E. Data flows will support archiving and verification requirements.

2. Existing pre-processors for MAP, MAT, and MAPE *will not* be migrated to CHPS.

   A. CAT RFCs have committed to developing all observed and forecast forcings in a gridded form that will be provided directly to FEWS. CAT II RFCs are encouraged to follow the same path and use tools developed for BOC as appropriate.

      i. CAT RFCs are using a variety of local and national tools and datasets to accomplish this. Details are available from the CHPS Forcing Team. Interest exists in standardizing on MPE-DQC and GFE at some time in the future.

   B. FEWS accepts gridded forcings in GRIB1 format. Gridded forcings can be integrated to mean area values using RFC provided basin shape files and existing FEWS utilities.

      i. FEWS does not have the ability to edit grids. All grid editing must be done external to FEWS and CHPS.

      ii. netCDF importers are also available, but only for CF compatible format netCDF. Existing AWIPS netCDF is not CF compatible.

   C. Observed and forecast MAP, MAT, and MAPE values can be exported from NWSRFS and imported into FEWS for validation and evaluation purposes. This also represents a temporary fall-back methodology if one or more RFCs cannot reliably generate forcings with other tools.

   D. Investments in pre-processors internal or external to CHPS are considered a post-BOC II activity.

E. CHPS will accept gridded forcings at any time step from sub-hourly to monthly.

F. Preprocessors for MAP, MAT, and MAPE are still needed to develop calibration datasets. This requirement for calibration datasets will be attached to the set of requirements associated with model calibration.

G. CAT II RFCs have provided their current and proposed methodologies for generating MAPs, MATs, and MAPEs for BOC II. CAT II RFCs will continue to work locally to develop reliable forcings for BOC II.

H. CAT RFCs have not demonstrated that reliable forcings can be generated outside of NWSRFS. Information from the CAT work will inform and supplement CAT II efforts. A full resolution of the direction is expected before the end of calendar year 2009.

I. The inclusion of the existing NWSRFS preprocessors in CHPS (e.g. through wrapping) is not a viable option because of the interplay between NWSRFS data structures and the actual science algorithms. CAT II RFCs need the ability to:

   i. Estimate values when missing based on station characteristics and values of “nearby” observations. This is commonly used to estimate DUMMY stations with specific characteristics.

   ii. Temporally estimate values where values are available for some times but not others or for extremes (tmax,tmin) but not for specific times.

   iii. Dynamic spatial estimation of values from point observations.

   FEWS contains algorithms to compute areal values based on a weighting scheme or based on Thiessen Polygons. It does not have algorithms to estimate missing data. CAT RFCs will be evaluating the ability of existing and developing tools to handle i, ii, and iii above and will steer development and CAT II efforts as more information becomes available.

3. The OFS RRS function exists in the FEWS system and is currently being tested to ensure that it performs as needed.

4. Data visualization and data QC

   A. Sophisticated data visualization and quality control functions are required. How and where QC is performed is important as it impacts production.

   B. BOC II will rely on a combination of existing visualization tools (for example, WHFS and local apps) and those available natively within FEWS.

C. To date, no QC functions have been ported. BOC will rely on local applications and existing AWIPS software (such as WHFS) to perform data QC. BOC II will do the same.

D. Data QC and visualization capabilities within FEWS will be explored and leveraged as appropriate.

E. Data QC'd within the CHPS environment will be provided to external (IHFS, Archive, other) databases.

F. The selection and/or development of any QC or visualization tools within CHPS will need to be closely coordinated with AWIPS II to avoid duplication of effort.

5. Workflows will emulate the Forecast Group and Segment structure of the current NWSRFS implementations to simplify migration and training.

6. NWSRFS Operations

A. The following NWSRFS operations have been or will be migrated to CHPS where they can be used with existing calibrated parameter sets:

TATUM	SARROUTE	CHANLOSS	
CONS_USE	STAGE-Q	LAG/K	LAY-COEF
SSARRESV	MUSKROUT	UNIT-HG	RES-J
RES-SNGL	RSNWELEV	SAC-SMA	SNOW-17
CONT-API	GLACIER	SAC-HT	

FEWS analogs have been identified and verified for the following NWSRFS operations. As such these operations will not be migrated from NWSRFS to CHPS:

CLEAR-TS	CHANGE-T	LOOKUP	LOOKUP3
ADD/SUB	DELTA-TS	SET-TS	ADJUST-Q
TIDEREV	STAGEREV	MULT/DIV	ADJUST-H
NOMSNG	MEAN-Q	WEIGHT-TS	ADJUST-T
MERGE-TS			

7. AWIPS baseline DHM *will not* be migrated to CHPS.

8. HL-RDHM will not be migrated to CHPS for BOC II; however, RFCs can continue to run HL-RDHM outside of CHPS as an external source of data until such time as an operational distributed modeling capability can be introduced into CHPS.

A. Output from HL-RDHM can be imported into CHPS.

B. Need to develop OCWWS/OHD support strategy as more than half of the RFCs will likely be using HL-RDHM as a means to generate gridded FFG.

9. FLDWAV and DWOPER *will not* be migrated to CHPS with the exception of the DWOPER blend function. RFCs will need to port hydraulic modeling requirements to HEC-RAS or another hydraulic model which has been adapted for FEWS and is readily available from the FEWS user community.

    A. This establishes a requirement for HEC-RAS capability within CHPS.

    B. Calibration of HEC-RAS will remain external to CHPS.

    C. Transition support will come from OHD/HL/HSMB Hydraulics Group.

    D. HEC-RAS training has been initiated and will continue

    E. It has been noted that it may be better to develop HEC-RAS implementations from scratch rather than attempting to migrate datasets from FLDWAV implementations (OHRFC).

10. The existing NWSRFS generation of FFG *will not* be migrated to CHPS.

    A. FFG will be generated by processes external to CHPS as a stop-gap measure at both CAT and CAT II RFCs.

    B. FFG generation should be an integrated CHPS capability post-BOC II.

    C. An inventory of RFCs shows the following for FFG generation.

        i. AB,WG,LM, and SE (all SR) using HL-RDHM based FFG (GFFG).

        ii. CB, CN, NW (all WR) using GIS-based procedures.

        iii. APRFC is not generating FFG.

        iv. NE working to implement GFFG.

        v. MB is running GFFG in parallel with NWSRFS FFG and conducting an evaluation

        vi. NC and NE conducting work to integrate the effects of snow in GFFG. This looks hopeful and will have implications for MB, OH, and MA.

        vii. OH looking seriously at GFFG.

        viii. MA considering GFFG.

    D. Steps needed to operationally implement GFFG in CR and ER RFCs relate to the effects of snow and OCWWS/OHD support.

E. Since GFFG appears to be a developing standard for NWSRFS FFG replacement, it is important to develop a support and implementation assistance strategy. ACTION: OCWWS and OHD (with assistance from field developers).

11. The existing NWSRFS generation of HWG *will not* be migrated to CHPS.

    A. MA, MB, LM, NE, NC, and SE are currently producing an FFH product using the NWSRFS FFG operation. Durations include 1, 3, 6, 12, and 24 hours. The most interesting periods for WFOs are 1 and 3 hours.

    B. The "science" to generate 1 and 3 hour FFH from established 6-hr timestep models is unclear and efforts to find it have not been successful to date.

    C. FEWS is capable of running iteratively to find the precipitation needed to reach a critical flow threshold. FEWS does not contain the "science" to derive a 1 or 3 hour unit hydrograph from a 6 hour unit hydrograph.

    D. The NWSRFS procedures are fundamentally weak so it does not make sense to bring them into CHPS.

    E. Some sort of functionality is needed to support this operational requirement. ACTION: OCWWS and OHD.

12. NWSRFS to FEWS migration tools have been developed and may be refined over time. These tools translate existing segment definitions used in NWSRFS into workflow components needed by FEWS

    A. Utilities will be provided to transfer carryover from NWSRFS to CHPS for migrated workflows.

13. Significant work is underway to develop and implement within FEWS a forecaster interface that provides capabilities equal-to or greater than NWSRFS. Initial demonstration in June '09.

14. The following Run-time modifications (MODS) will be supported:

    A.

IGNORETS	TSCHNG	TSADD	ROCHNG	HECRAS
FMAP	CHGBLEND	SACCO	UHGCHNG	SACBASEF
SSARREG	WECHNG	AESCCHNG	SETQMEAN	APICBASF
MFC	RAINSNOW	ROMULT	UHGDATE	APICCO
RRICHNG	RRIMULT	SETMSNG	QCSHIFT	AEICQN
SWITCHTS	WEADD	UADJ	QPSHIFT	

    B. An interactive forecaster interface for MODS is under development by Deltares with guidance from the CAT. This will be initially demonstrated in June '09.

    C. MODs can be read in from an external source.

15. Post-processing and product generation

A. Features related to product generation will be accomplished through the porting of existing tools and local applications into the CHPS environment under the assumption that time series, mean areal, and gridded data (observed, simulated, and forecast) and other static and dynamic information can be extracted and/or exported from FEWS for such purposes on demand.

B. To the extent possible, standardization and the development of common tools will be pursued, but it is recognized that each RFC has specific product generation requirements that must be maintained through BOC II. Nonetheless, some fundamental capability should be provided as a part of BOC II to limit needless local applications.

   i. Deltares is looking at ABRFC GXSETS as a possible baseline standard for BOC and BOC II.

   ii. OCWWS/OHD (RDM) ACTION to gather product generation requirements and compare with various versions of XSETS.

C. To the extent possible, post-processing tools will be integrated into CHPS to avoid redundant processes and steps.

D. Transfer of operational time series from one RFC to multiple locations (including another RFC) must be supported.

16. Ensemble capabilities will support existing operational products and services.

A. ESPADP capabilities will be provided by an early implementation of the XEFS Ensemble Product Generator (EPG).

B. ESP products include those required by AHPS as well as trace ensemble files. Formats must be consistent with current customer/partner requirements.

C. Ens_pre and Ens_post have been wrapped and are available in CHPS.

D. Ensemble generation within CHPS will be accomplished with minimal adjustment to deterministic workflows. Generated ensembles will meet current process and user requirements. Ensembles will carry “year” identifiers where appropriate and will be available for exchange between RFCs.

E. We have much to learn with respect to ensemble operations within CHPS. CAT RFCs will evaluate and explore ensemble capabilities and ensure that BOC I requirements are met. This information will be used by CAT II RFCs to ensure that BOC II ensemble requirements will be me.

F. The issue of performance is important. Performance criteria must be established and met. RFCs can expect performance to be slower than NWSRFS. Deltares is investigating ways to remove bottlenecks and increase simulation speed.

17. Calibration of model parameters *is not* part of BOC II

A. This creates a temporary dependency on MCP3 and the ICP to develop required model parameters which in turn prohibits the use of non-NWSRFS models (not good). The CAT elevated this issue at the March 2009 workshop. A team is being formed to address the calibration requirement (lead by HSEB). The goal is to deliver a CHPS Calibration Interface by January 2010. The fall-back position for the CCI is a "wrapped" MCP3 process.

B. The whole notion of calibration in the CHPS era needs to be addressed from first principles by a diverse team with representation from HSMB, HSEB, RFC, and perhaps the modeling community. This activity is critical but it is not a part of the BOC II process. This will necessarily include the development of historical model forcings.

18. Hardware

A. BOC II will make use of prototype hardware specifically selected and procured for the CHPS implementation to define and validate the CHPS hardware requirements as well as to conduct the migration and subsequent parallel operations without disturbing AWIPS I or AWIPS II. As currently envisioned, this consists of two sets (online duty and online standby) of rack-mounted servers (Master Controller, Forecasting Shell Server, and Database). All RFCs will begin migration with only the online duty system hardware (one set of hardware). The second set of hardware (online standby) will be available for the CAT RFCs at the start of BOC parallel operations and for the CAT II RFCs at the start of BOC II parallel operations. Off-line systems (recommended by Deltares) used for calibration and testing of new models and workflows may be deployed using local funds or re-purposed (less capable) systems.

i. Hardware and software support will be provided. New systems will be covered by a 3-year Dell warranty.

ii. Systems will be installed in a standardized fashion with specific locations in the REP rack and assigned IPs. Randy Reiman will make IPs available to CAT II RFCs so that the address space can be cleared in advance of October 2009.

iii. Complete installation instructions will be provided at least 2 week in advance.

iv. A redesign of the hardware environment is probable in light of AWIPS II and the need to mainstream CHPS into baseline NWS operations. This redesign is expected in the post-BOC II time frame.

19. Failover and Off-Site Backup

A. Hardware failover is explicitly accounted for with the synchronized online duty and online standby systems.

B. Off-site backup capability will be a subject of discussion over the next year.

i. Database synchronization may be leveraged to accomplish a portion of the required capability.

ii. Deltares is currently investigating and expects to develop the ability to synchronize information across more than two systems.

C. On-site backup capability is a requirement for periods when AWIPS is down (scheduled and unscheduled).

D. The CAT will engage other NWS backup projects in order to bring multiple related efforts together and leverage an effective solution (e.g. OSIP RFC backup project, OSIP Thin Client project, RFC AWIPS Configuration IWT).

20. Training

A. RFCs will need FEWS system management and trouble-shooting training for some staff.

B. RFCs will need NWSRFS to FEWS migration training for some staff.

C. RFCs will need FEWS configuration training for some staff.

D. RFCs will need FEWS user interface training for all staff.

E. RFCs will need basic HEC-RAS training for some staff. Some RFCs will need advanced training.

F. RFCs will need technical training on how to access (read) the FEWS database or invoke data export to support current post-processing and product generation applications for some staff.

G. Some staff at the RFCs will need training related to model adapters and the integration of new tools within FEWS in order to leverage the attributes of CHPS.

21. Configuration tools

A. Additional tools will be needed to assist RFC developers in the migration and configuration of their systems. Deltares has developed an effective set of migration scripts that are continuing to be tuned through use at the CAT RFCs.

B. FEWS configuration requires and understanding of XML and the availability of XML editors (e.g. oXygen, gedit). The requirement for oXygen has not been fully established.

22. Common tools and utilities

A. Tools and utilities will be developed (by CAT RFCs) in the process of validating forcings and simulations in parallel operations that will be collected, improved, and provided to CAT II RFCs for use in migration and subsequent parallel operations.

23. Support and maintenance

A. In the initial phases, significant support will be provided by Deltares.

B. As the project moves forward, more and more support will come from OCWWS/HSD, OHD, and RFCs who have developed skills.

C. Migration Partners

i. CAT RFCs will serve as coaches for the CAT II RFCs during their migration process.

a. NWRFC will coach APRFC and MBRFC

b. CNRFC will coach CBRFC and NCRFC

c. ABRFC will coach WGRFC, LMRFC, and SERFC

d. NERFC will coach MARFC and OHRFC

24. NWSRFS Techniques

A. OHD is working through the information provided by the RFCs to establish the list of required NWSRFS techniques. The generated set will be circulated among the RFCs for validation when complete. NWSRFS Techniques equate to “Runtime Options” in FEWS.

25. IHABBS

A. Inventory of use by RFC has been received.

B. Basin boundary delineation is not currently a function of NWSRFS and will remain external to CHPS through BOC II.

C. Several RFCs use the unit hydrograph estimation feature of IHABBS.

D. This remains an important topic, particularly in regions that require a very high resolution (and highly accurate) DEM and flow direction grids in order to generate accurate boundaries.

26. Rating Tables

A. FEWS has a rating table schema that is currently being developed and evaluated for the needed attributes.

B. CAT RFCs will work through the process of providing rating tables for use in CHPS.

i. Issues include collection, format, adjustment, (others) and distribution.

ii. Work in CR and SR is still needs refinement

C. Rating table handling will remain external to CHPS through BOC II.

27. Others

A. None at this time.

End of final discussions on 4/28/2009